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Dimensional Tolerances

With a problem logically and exhaustively stated, the solution is usually in sight. If there be a weakness in the report of Sub-Committee T.S.12 of the Technical Council of the Institute of British Foundrymen on "Dimensional Tolerances for Castings," printed in the September issue of its "Journal," it is failure to give a logical definition of a casting. A casting may enter a weight range of which the limits are an ounce and 200 tons, whilst it may be made from an infinitely wide range of alloys. The quantity required may vary from one to a million. Moreover, castings may be used for an incredible number of purposes and be manufactured by a large number of processes. Thus, before real progress can be made, the problem of dimensional tolerances requires to be broken down. There has, in the past, been a realisation of this fact, as a Report was published in 1935 on "Dimensional Tolerances for Castings, *with Particular Reference to Malleable Cast Iron.*" The italics are obviously ours.

The Report is excellent as clearing the ground for future work. Primarily, it deprecates the existence of much vagueness; yet this state of affairs will continue so long as official documents contain phrases like "as nearly as is practical" and "a sufficient allowance." Then it sets out a discussion under four headings. In connection with the first of these—Co-operation Between Manufacturer and User—the following observation is made: "The most helpful step of all would be for the purchaser to state at the time of placing an order the degree of accuracy required. This should be stated clearly, in unambiguous terms, and should include such features as parts which are to assemble or fit other components in the cast state. This would enable the founder to ensure that proper equipment is available and to carry out dimensional inspection of patterns to prevent the deadlocks which frequently arise from castings being made from patterns supplied by the purchaser." The second heading is Drawing Office Practice and Conventions; several useful comments are made, of which not the least important is the recommendation that where casting drawings are supplied, detailed drawings of the component should also be furnished in order to increase the information available to the founder.

Under the third heading, Jig Locations or Machining Methods: "It is recommended to set-up for machining from surfaces of the casting which are made by mould surface and not by cores, as cored surfaces are liable to inaccuracies arising from placing the core in the mould. If the surfaces to be used are indicated on the drawing, the founder is recommended to endeavour to arrange the moulding so that these surfaces are part of the mould face and are not covered by an inserted core. Here again it is not always possible to employ this principle as many castings are made entirely in cores. In these cases the use of special bosses or pads for jigging (mentioned earlier) is strongly recommended. As such, they are subject to extra care when patternmaking and planning moulding operations and feeding arrangements, etc. If such pads are not desirable or permissible from a design point of view, it is emphasised that the founder should know the points or areas to be used as locations, when care and special technique can be employed." The final subject for comment is Founders' Inspection, and this contains the recommendation that "purchasers of castings should review their requirements on a long-term policy to permit the foundry to produce the best possible equipment for the job

(*Continued overleaf.*)

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Dimensional Tolerances

in hand. Frequently, trial orders warranting only soft wood or similar patterns are followed by bulk orders, and disappointment is expressed if new patterns are requested or the castings do not show the original accuracy and definition."

It is obvious from the excerpts we have made, which mostly refer to improved methods and practices, that for an important section of castings production, that is, generally speaking, those made by repetition methods, there should come a time when a new attempt could be made to standardise dimensional tolerances with the hope of tangible results. By clarifying the situation, the Committee has probably gone further in the direction of ultimate standardisation than a cursory examination of the Report would disclose.

Donation to South African Branch

Col. A. H. Guy has given £50 to form the nucleus of a fund to furnish annually a gold medal to be awarded to South Africans who have given outstanding service to the foundry industry of the Union. Col. Guy played a prominent part in the creation of the South African Branch of the Institute of British Foundrymen and was its second president. During the war he was for two years president of the South African Red Cross Society. He is on the directorate of several foundries and engineering companies.

A New Film Strip

The well-known film strip series on foundry technique is now extended by the publication of No. 6 covering loam moulding. The series is being produced by Educational Publicity Limited in co-operation with the Council of Ironfoundry Associations (Derbyshire House, Belgrove Street, London, W.C.1) and Newton Chambers Limited. The particular job detailed is the making of a cylindrical still casting, and included with the lecture notes is a break-down sheet. This section details no fewer than 80 separate operations to be performed. Its inclusion does materially enhance the value of the strip. Even foremen will probably find it helpful in speeding-up production, whilst the estimating department will have available a potential example for more reliable quotations. However, these are incidental, for the main object is the instruction of the neophyte moulder. This aim has been very well carried out, whilst the cost of the film and the lecture notes has been kept at the reasonable figure of 15s.

Sir John Cass Technical Institute

The Prospectus for the session 1948-49, which gives details of the courses in metallurgy, is now available on application to the Secretary of the Institute at Jewry Street, Aldgate, London, E.C.3. Evening classes in metallurgy are to be arranged if the demand warrants their organisation.

Forthcoming Events

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

SEPTEMBER 25.
Institute of British Foundrymen.
East Midlands Branch:—Presidential Address by H. P. Radford, followed by "Notes on American Foundries," by F. W. Neild. Joint meeting with Derby Society of Engineers at the School of Arts and Crafts, Derby, at 6 p.m.
West Riding of Yorkshire Branch:—Presidential Address by F. Squires, at 5 p.m., at 1, Mannville Terrace, Bradford, followed by a Paper by G. W. Nicholls at the Technical College at 6.30 p.m.

SEPTEMBER 27, 28, 29 and 30.
Institute of Vitreous Enamellers.
International Congress and Annual Conference in London. Programme printed in the JOURNAL, August 5.

SEPTEMBER 29 and 30.
Institute of Welding
Autumn Meeting, September 29, at 2.30 p.m., at the Institution of Civil Engineers, Great George Street, London, S.W.1, and 10.30 a.m., on September 30, at the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1.

SEPTEMBER 29.
North-Western Fuel Luncheon Club.
Opening Meeting and Address of the new President, W. J. Drummond, at the Engineers' Club, Albert Square, Manchester, assembly at 12 noon for 12.45 p.m.
Institute of British Foundrymen.
London Branch:—Works' Visit to John Every (Lewes), Limited, at 2.15 p.m. Tea at All Saints' Hall, Station Street, Lewes, at 4 p.m., followed by Presidential Address by P. D. Pincott.
Institution of Production Engineers.
Birmingham Section:—"Education for Management," by Lt.-Col. L. Urwick, O.B.E., M.C., M.A., at the Chamber of Commerce, New Street, Birmingham, at 6.30 p.m.

OCTOBER 1.
Institute of Economic Engineering.
North-West London Section:—"Group Fellowship Incentive Schemes," by A. J. Speakman, at the Lecture Room, Kodak Hall, Wealdstone, Essex, at 7 p.m.

OCTOBER 2.
Institute of British Foundrymen.
East Midlands Branch—Lincoln Section:—Works' Visit to Ruston and Hornsby, Limited, and Presidential Address by A. Swain.

Course in Foundry Management

A post-graduate course in foundry technology and management is to be held at the Royal Technical College, Salford. It will provide an up-to-date review of progress during the past 10 years, setting management and technical factors in their proper relationship. The subject matter covers the complex problems of casting technology at all stages and its relation to management and control.

Any foundrymen interested in the Course are requested to communicate with M. Seaman, Esq., P. R. Jackson & Company, Limited, Salford Rolling Mills, Manchester, 5, who will be glad to supply particulars of the syllable, *etc.*

THE GRAHAM CAMPBELL FERRUM COMPANY PROPRIETORY LIMITED, of Geelong Road, Footscray, W.12, Victoria, Australia, are desirous of recruiting from this country six good jobbing moulders, twenty pipe-moulders and an equal number of foundry labourers.

The Cleaning of Steel Castings*

Improved Conditions for Fettling

By A. B. Lloyd, B.A., A.M.I.P.E.

I. INTRODUCTION

The Author, in this Paper, is setting out to deal with as many aspects as possible of the processes involved in the separation of steel castings from the materials used to make the mould. He does not propose to deal with the removal of feeding heads, grinding, or rectification by welding.

The object, in cleaning castings, is to remove any adhering sand which will prevent them from fulfilling the functions for which they were designed. For most castings, this means that all surface sand must be removed, and also any sand under the surface which will appear during machining.

In the perfect foundry, all that a casting would need would be a good shaking and all the sand would fall away, leaving a clean casting. It is an unfortunate fact, however, that present knowledge is insufficient to permit the production of such steel castings consistently. It might be possible to make them with certain special materials, but the cost would be uneconomic. That they cannot be made now does not mean that they will never be made, and no effort should be spared in attaining this end. There is, therefore, full scope for improvement of workmanship in the foundry, both by the development of better methods of training, and as a result of research designed to develop better stripping qualities for moulding materials.

It is intended to deal with this moulding material question in some detail in the first part of the paper, since steel presents special difficulties to the foundryman by virtue of the fact that it is cast at temperatures at which the refractories commonly used undergo both physical and chemical changes. Refractory materials are available which do not undergo such changes, *e.g.*, zircon, but, except for special applications, economic considerations rule these out. In addition to these changes within the refractories themselves, physical and chemical interactions—the nature of which is not fully established—take place, under certain conditions, between the metal and the moulding material. These reactions lead to the phenomenon known as "burn-on."

There are some questions, therefore, which must be posed, and answered only in so far as answers are available on the basis of existing knowledge. The questions which cannot be answered point to the need for research of an *ad hoc* or fundamental character, according to the nature of the problem involved. The questions are as follows:—

(*a*) What moulding materials and practice must be employed to enable the moulding material to fall cleanly away from the casting when it is knocked out of the mould? If this cannot be done, what sand practice will give the lowest cleaning cost? This lowest cost will probably be obtained when all cleaning can be done by abrasives and not by chipping or grinding.

(*b*) What plant and methods must be employed to remove the various forms of adhering sand at minimum cost?

(*c*) What steps can be taken to prevent the release of dust into the fettling shop atmosphere, and to protect men from it on operations where it is not practicable to trap it at the source?

II. CHOICE OF MOULDING MATERIALS

As stated in the introduction, moulding material should fall away from the surface of the casting as it is shaken out of the mould. This ideal has not, up to now, been fully achieved in practice, and, as a second best, a moulding material is sought which may be easily removed, either by wet or dry abrasive cleaning.

The main cause preventing the attainment of these objectives is the scarcity of published knowledge of the behaviour of moulding materials in contact with steel at high temperatures, and the fact that economic

FIG. 1.—A LARGE NECK AND WOBBLER PINION, SHOWING HEAVY LAYERS OF BURNT-ON SAND AT RE-ENTRANT ANGLES.

* Presented at the London Conference of the Institute of British Foundrymen, June, 1948.

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considerations normally prevent the use of moulding materials other than silica sand, with either natural or added bond. The exception to this arises in the case of foundries making heavy castings, where it is customary to use "Compos" based on calcined clays and other materials.

As far as the first point is concerned, experimental work on the high-temperature properties of sand is under way. Until this information is available, a large amount of empirical knowledge, based on previous experience of sands in actual practice, can be drawn on. The behaviour of moulding sands in contact with steel can, to some extent, be correlated with their behaviour when subjected to standard A.F.A. tests at room temperatures. A.F.A. room-temperature tests are described in full detail in "The Foundry Sand Testing Handbook."[1] Briefly, they measure the following properties:—Moisture content; permeability; and mechanical strength when green and after drying.

These, together with a knowledge of the sand mixture and the chemical composition of the refractories and bonding materials used, will provide a reasonably reliable guide to the probable behaviour of the sand in the foundry. Deductions from such tests, however, can be misleading, and should always be checked by foundry trials under production conditions on a limited scale.

FIG. 2.—A SMALL CLUTCH CASTING, SHOWING THE BURNT-ON SAND REMAINING BETWEEN THE CLUTCH-TEETH AFTER SHOT-BLASTING.

Considerations of economy and availability compel steel foundries in Great Britain to use some form of silica sand as a basis of their moulding materials, except for heavy castings. "Compo," consisting essentially of a mixture of calcined fireclays, old crucible pots, plumbago, and broken firebricks, is a satisfactory moulding material, giving a good surface and freedom from scabbing. It is particularly suitable for heavy castings, but if Compo be used for heavy castings and silica sand for medium and light castings in the same foundry, two separate preparation and reclamation systems are required, and this is uneconomical.

Great Britain being a small country, the comparative transport costs of different sands is not a large factor in deciding on a sand to use to suit the location and type of work to be produced in a given foundry. Foundries have, on the whole, a wide choice in the sands available in Great Britain, with only slight differences in transport costs.

The main difference between the cost of alternative moulding materials will be in the difference in price and quality of the bonding materials used. These differences present opportunities for economy in the cost of moulding materials, but such economies are only justified in so far as they do not lead to increases in the cost of fettling and aggravation of health hazards in the fettling department. A saving in the cost of moulding materials can be wiped out ten times over by increased fettling costs, and any changes in sand practice, designed to reduce the cost of moulding materials, need to be carefully controlled from this point of view.

The main defects which increase fettling costs are:—(*a*) Burn-on and metal penetration; (*b*) scabbing and spalling; (*c*) fritting.

(*a*) Burn-on and Metal Penetration

The Author considers burn-on to have taken place when it is not possible to remove the sand from the casting by abrasive cleaning. Examples are shown in Figs. 1 and 2. Metal penetration occurs in cores and at re-entrant angles. The metal penetrates the sand, forming a hard mass which can only be chipped out with great difficulty. It is sometimes possible to get a chisel under the mass and lever it out. An example of such a mass of metal-penetrated sand is shown in Fig. 3. Fig. 4 is a good illustration of a sand core partially penetrated by metal.

Burn-on is regarded merely as a mild case of metal penetration. In support of this, be it noted that Caine's view is that burn-on is caused by metal penetrating the sand and keying it on to the casting.[2] The Author, however, prefers to say that the metal adheres to the sand and not the sand to the casting.

The principal methods of preventing burn-on and metal penetration are:—

(i) Maintaining the permeability of the moulding material at the lowest figure, which experience

shows does not give rise to the other defects. It has been found that an A.F.A. permeability of 100 is sufficient for green-sand and skin-dried castings. For heavy dry-sand castings a sand of permeability 10/20 should be used. For light cores, a sand with a permeability of 120/180 is satisfactory. For heavy cores, however, particularly when surrounded by heavy sections of metal, the worst conditions for encouraging metal penetration arise, and a permeability of 10/20 is again desirable. It may be mentioned, in passing, that high-duty refractories, such as zircon sand and zircon flour, mixed to give an extremely low permeability, form a very satisfactory mixture for critical cores in heavy sections. The saving in fettling costs justifies the use of zircon in such cases, in spite of its high raw-material cost (ten times that of silica sand).

(ii) To use a moulding material with a fusion temperature above the temperature of the steel which will be in contact with the mould. If the fusion point of the sand be too low, the sand fuses and forms pores into which the metal penetrates, causing very severe burn-on.

(iii) To paint the moulds and cores. The paints normally used are suspensions of very fine materials, and these, on drying, coat the moulding material and seal the small pores in it, thereby preventing metal penetration as long as the paint layer is unbroken. It is very important, however, not to choose as a paint a material which will react with the moulds and cores. If a reaction occurs, the moulding material may fuse, thus forming pores and resulting in severe burn-on, as mentioned in paragraph (ii) above. On the other hand, some slight fusion of the paint may be desirable in order to form an impervious layer. It is thought that this is the reason why silica flour makes a better paint than zircon flour for heavy castings. The zircon flour does not fuse, and is therefore more permeable.

(iv) To add carbonaceous matter to the moulding material.

(*b*) **Scabbing and Spalling**

It is unfortunate that the main method of preventing burn-on tends to increase both scabbing and fritting. Scabs on top parts occur as the result of portions of the mould falling away on to the rising metal surface. It is thought that this spalling is largely due to the sudden expansion of quartz from the α to the β form at 575 deg. C. This change is very sharp and is accompanied by expansion. The strains set up by this expansion, when added to the strains set up by the sudden heating, tend to dislodge flakes of sand. These float up on the rising metal, forming scabs when trapped against the top part. These scabs, though fairly easy to chip out, give rise to the necessity for a large amount of rectification by welding. Examples are shown in Figs. 5 and 6. Fig. 6 gives a good example of the failure of the sand in the cope, in the case of a large, flat casting, in which the metal rises slowly towards a large horizontal surface.

In the Author's experience, castings made in synthetic sand, with its low clay content, are especially prone to spalling, and measures have to be adopted to overcome it. (Compo, on the other hand, has little tendency to cause spalling with the characteristic scabbing that results, and this is probably explained by the absence of free quartz.) These measures include:—(i) Increasing the speed of teeming; (ii) tilting the mould to limit the exposure of the cope face to the rising metal; (iii) adding organic substances or other combustible materials, which burn out at the inversion temperature, thus leaving space for the expansion to be taken up; (iv) increasing the clay content of the sand to raise dry-strength and hot-strength, and (v) cutting brackets in the mould face (this latter method is not recommended as a general practice, owing to the increase in fettling caused by the necessity for the removal of brackets).

One feature of spalling is that it is sporadic, *i.e.*, some castings of a given design may be badly scabbed and others perfectly clear. This is, of course, partially due to factors such as a difference in ramming, arrangement of gaggers, etc.

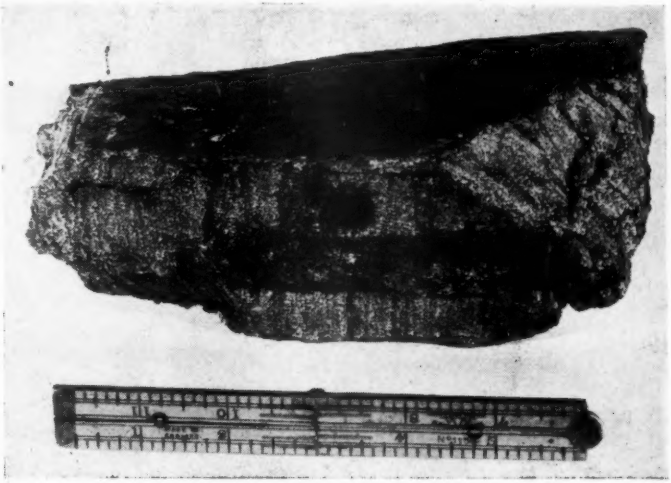

FIG. 3.—MASS OF SAND, PENETRATED WITH METAL, REMOVED FROM A RE-ENTRANT ANGLE OF A LARGE CASTING.

The Cleaning of Steel Castings

(c) Fritting

A small core in a large section must be made with a large amount of fines to reduce the permeability and prevent metal penetration. The fines have a lower fritting temperature than the coarser sand, and the result is that the core frits into a stony mass which cannot be removed by abrasives. This can be prevented by using a material with a higher fritting temperature than silica, such as zircon.

There are other defects in steel castings resulting from sand practice, such as erosion at gates and loose sand, but the cures for these are fairly well known, and the Author does not propose to deal with them. Other causes of increased cleaning costs are bad moulding practice, such as putting gaggers too near the surface of top parts, and too soft ramming. These, again, can be prevented by proper technical supervision.

III. GENERAL SEQUENCE OF CLEANING PROCESSES

The stripping of steel castings normally divides itself into five main components, namely:—(1) The separation of the casting from the moulding box; (2) the removal of substantial masses of sand enclosed in the castings in cores and pockets; (3) the removal of adhering or burnt-on sand; (4) the removal of surplus metal, and (5) the removal of scale arising from annealing or heat-treatment.

It was stated in the introduction to the Paper that an ideal procedure—if it were practicable—would be to give the casting a good shaking on the knock-out in the expectation of it being completely free from sand from then onward. For all except the heaviest castings it is, in fact, desirable to remove such adhering sand from the casting as can be shaken off on the knock-out by the use of a vibrating grid or other suitable means.

The sledge hammer is a useful tool where low carbon steel castings are being knocked out, but trouble will soon be encountered through cracks if this treatment be applied either to high-carbon steel castings or alloy steel castings, since these are in a highly brittle condition at the knocking-out stage. In the case of heavy castings, however, the most suitable process devised to date for removing sand is the wet-cleaning method known as the "Hydro-Blast process." A Hydro-Blast plant thrives on sand, and the more sand that is put into it, the better it operates, since an adequate supply of abrasive is thus maintained in the cleaning jet. This is, therefore, an exception to the usual rule of keeping as much sand as possible in the foundry and avoiding sending sand to the fettling shop on the castings.

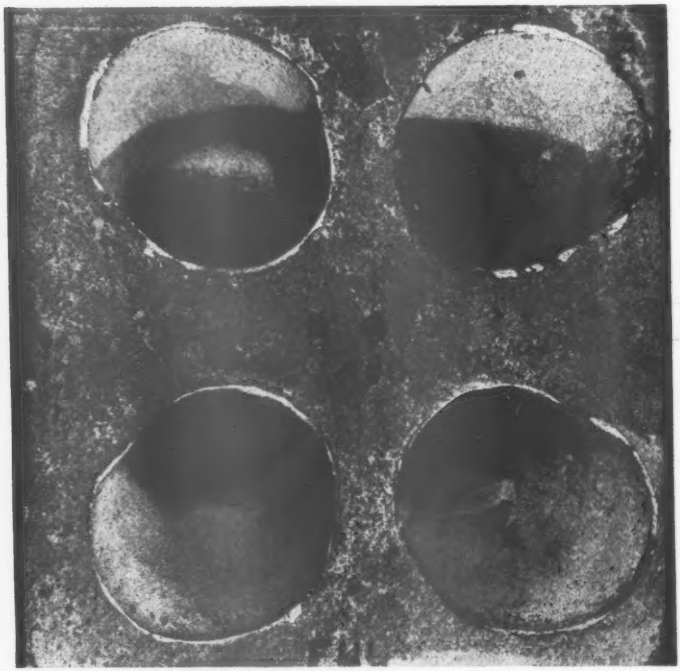

FIG. 4.—CASTING WITH CORE PARTIALLY PENETRATED WITH METAL, SHOWN AFTER SHOT-BLASTING.

Hydro-Blast and Shot-blasting

The next stage of the process consists of the removal of the sand left on the castings after leaving the knockout, which, in the case of large castings, involves the removal of substantial masses of sand enclosed in internal cores and pockets. The Hydro-Blast process, referred to in detail in the next section dealing with plant, is eminently suitable for this operation, having replaced the crude operation known as "mucking," which involves digging the cores out with an extended bar fitted into an ordinary pneumatic hammer. This "mucking" process is one giving rise to large volumes of coarse dust, some of which is inhaled by the operators unless they wear respirators. In this respect, therefore, the Hydro-Blast process makes a substantial contribution to improved working conditions in the fettling shop by permitting the most unpleasant operation to be carried out under

clean conditions without risk to the operator.

In the case of small castings, sand adhering to the castings after leaving the knock-out is removed, for the most part, in airless shotblast plants of either the revolving-barrel or turntable type, the operator in these cases works outside the cabinet in which the castings are being processed. This type of plant provides healthy conditions for the operators, since the dust extraction arrangements provide a negative pressure inside the cleaning chamber which draws clean air into the plant, and takes dust-laden air to the filter rather than allowing it to leak out into the fettling-shop atmosphere.

It has not, so far, been possible to devise plants which are capable of cleaning all types of castings without the need for the operator to enter the shot-blast chamber, and it is still found necessary to use manually-operated compressed air shotblast plants for medium-sized cored work. The Author considers, however, that developments which are taking place at the present time, both in the direction of airless cleaning and in the development of the Hydro-Blast process, should have a chance of rendering obsolete the compressed-air manually-operated shotblast plant within a reasonable period.

A suitable combination of Hydro-Blasting, compressed-air shotblasting, or airless shotblasting can be relied on to remove nearly all adhering sand unless the sand surface next to the casting be actually penetrated. Penetration is a condition which should be eliminated if sand practices and moulding techniques, advocated in the early part of the Paper, are adopted and made effective by proper methods of foundry control. Human nature being frail, however, the best-laid plans are apt to go astray, with the result that fettling of castings with sand burnt on to their surfaces has to be provided for, and will have to be provided for for some time to come in steelfoundry fettling shops.

FIG. 5.—MOULD RING CASTING, SHOWING BAD SCABBING IN THE PROFILE.

FIG. 6.—CLOSE-UP OF SURFACE OF LARGE CASTING SHOWING SCABS AND SAND INCLUSIONS DUE TO THE SPALLING OF THE TOP PART.

Where these conditions occur there are two alternative courses open: either to scrap the castings if the burn-on be very bad, or to persevere with pneumatic chisels until the metal-penetrated sand, adhering to the castings, be finally removed. It is sometimes easier to leave the removal of burnt-on sand until after the castings are annealed, and this point is dealt with in a later paragraph.

The elimination of burnt-on sand, however, will never make the use of a pneumatic chisel unnecessary in a steel foundry fettling shop, since there will always be some quantity of fins and flashes to be removed from castings in the state in which they leave the foundry, however good the moulding technique adopted may have been.

Removal of Scale

Consideration is now given to the question of the removal of scale which arises from the annealing or heat treatment of the castings. The old method consisted of pummelling the castings all over with a blunt-ended round bar fitted into the end of a pneumatic hammer. This process is very tedious, and drives as much scale into the surface of the casting as it actually removes. The technique of shotblasting,

however, has now developed to the point where it is applied to the de-scaling of the greater part of the tonnage of steel castings produced in this country, the only limiting factor being the size of casting which can be manœuvred into a shotblast chamber.

Annealing the castings is sometimes found to be beneficial in the removal of burnt-on and adhering sand, particularly where the penetration of the metal into the surface layer of sand is not deep. It is found, in practice, that, when castings are annealed, a surface layer of up to $\frac{1}{4}$ in. thick, according to the conditions in the furnace, is oxidised, and, if the oxidised layer is thicker than the depth of penetration, it follows that the burnt-on or adhering sand will fall away from the casting. Fettlers sometimes claim that, even with heavy penetrations, the penetrated sand comes off more easily after the castings are annealed than before, but the Author thinks that, in really bad cases, annealing the castings before attempting to fettle them does not make a great deal of difference.

IV. ENGINEERING DETAILS OF PLANT USED TO REMOVE ADHERING SAND

Wet Cleaning Plants

The only wet cleaning process which has made any headway in this country to date is the Hydro-Blast process, and it is now being widely applied here both in steel and iron foundries. Fig. 7 gives a good idea of a Hydro-Blast operator at work, and the protective clothing it is necessary for him to wear. Other processes, involving the use of water alone at a lower pressure than is used by the Hydro-Blast, have been developed in the United States and are known to be still in use there, but no attempt has been made to develop them in this country.

In the Hydro-Blast process, a pressure of 1,200 lbs. per sq. in. is currently adopted, but recent developments have indicated that more effective cleaning can be obtained using a pressure of 1,750 lbs. per sq. in. It is claimed that, with this pressure, casting surfaces, where there is no burn-on, can be stripped completely free from adhering sand. Sand is induced into a high-pressure gun, thus introducing an abrasive element into the high-pressure stream of water. The plant is fitted with a wet-sand classification system, which can provide for the reclamation of almost the whole of the sand removed from the castings in the fettling shop. Iron foundries, and one or two mass-production steel foundries in the United States, are recovering sand and re-using it in the foundry on a large scale, but attempts to reclaim used sand with the Hydro-Blast in this country have not been 100 per cent. successful, particularly as far as steel foundries are concerned.

It is not intended to deal in greater detail with the Hydro-Blast process, since full details of the plant and what can be expected from it were given by F. N. Lloyd in a Paper[3] presented to the Institute in 1944. More will be said later in the Paper regarding the Hydro-Blast in relation to working conditions in the fettling shop.

Dry Cleaning Processes

(a) Compressed-air Plants

Figs. 8 and 9 show two of the most common types of compressed-air shot-blast plant. In both of these it is necessary for the shot-blast operator to enter the chamber in which the process is carried out. These plants are normally worked at a pressure of 80 to 90 lb. per sq. in. Their application nowadays is confined to medium and heavy sized castings, lighter castings being almost exclusively handled by airless plants. Fig. 8 shows the type of room used for processing large castings, where the casting is run into the room on a bogie.

Fig. 9 shows a turntable-type room used for handling medium castings. The room is equipped with a turntable, half of which is inside the room holding the castings being blasted, and half of which is outside being loaded with the next charge. When the operator inside has finished his work, the turntable is rotated, the

FIG. 7.—VIEW OF HYDRO-BLAST OPERATOR CLEANING THE CORE OUT OF A LARGE CASTING.

operator starts blasting the new charge, and the completed charge is unloaded on the outside.

A considerable amount of attention has been devoted to the development of suitable nozzles. Foundries making a large variety of castings generally prefer to use a simple cast-iron nozzle of the type shown in Fig. 10. It is found that the cast-iron nozzle can be made smaller in overall diameter at the mouth, since it requires no supporting cover and can consequently be easily worked in inaccessible pockets. Its chief disadvantage is that its effective life is short, and that, towards the end of its life, owing to increased size of the orifice, it is wasteful in its consumption of compressed air, as the following figures show:—

Diameter of opening in ins.	Compressed air consumption at 80 lb./sq. in.	H.P. intake.
$\frac{1}{8}$	132 cu. ft/min.	26
$\frac{1}{4}$	430 ,, ,	84

A practice involving the use of cast-iron nozzles needs careful supervision if consumption of compressed air is to be kept within bounds, since operators find that the more worn their nozzle becomes, the more quickly can they clean the castings. When, however, this improvement in blasting time is achieved at the expense of other processes depending upon compressed air, the saving is heavily out-balanced by losses in other parts of the plant owing to loss of pressure in the compressed-air system.

Because of the wastefulness and short life of cast-iron nozzles, other types of nozzles have been developed in non-metallic materials, the usual principle being the incorporation of a carbide insert into a metallic holder. While these nozzles are satisfactory on flat and convex surfaces, they have disadvantages when used with intricate castings, owing to the bulkiness of the holder required to house the insert which forms the nozzle proper. Whilst the Author has carried out experiments with these types of nozzles in the past, he has not had much experience with them on a large scale, and would refer readers, for further information, to a Paper[4] produced by the Research Department of William Jessop & Sons, Limited, in March, 1947.

FIG. 9.—TURNTABLE SHOT-BLAST CABINET. CASTING ON R.H.S. COMPLETED, CASTING ON L.H.S. ABOUT TO BE PROCESSED.

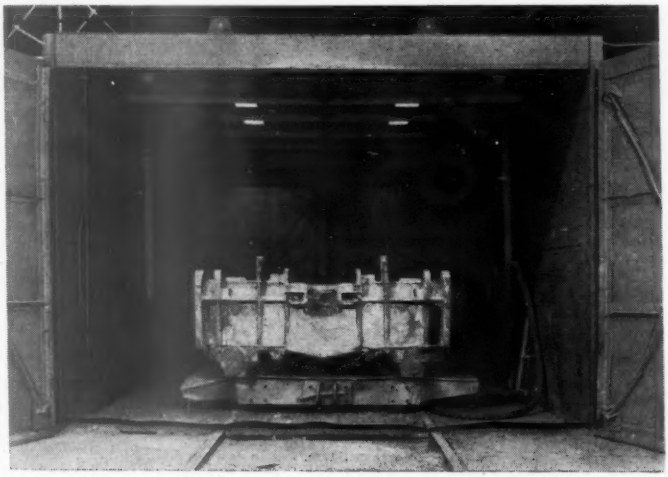

FIG. 8.—VIEW OF LARGE COMPRESSED-AIR SHOT-BLASTING CHAMBER SHOWING CASTING IN POSITION FOR PROCESSING. SHOT-BLAST HOSES SHOWN AT R.H.S.

(*b*) *Airless-type Shot-blast Plant*

This is so-called because it is independent of compressed air for its operation. An abrasive is fed into an impeller rotating at high speed, which throws the abrasive upon the work being cleaned. Fig. 11 shows the principle by which the shot is distributed over the surface of the casting by the impeller. A comparison between 12½ h.p. consumed by the airless impeller against an estimated 67 h.p. consumed by a ½-in. bore shot-blast nozzle at 80 lbs. pressure shows a worth-while improvement in work

The Cleaning of Steel Castings

attained for a given horse-power by an airless impeller as against a shot-blast nozzle. An airless impeller, however, can only work in a fixed position and, therefore, can only clean work coming within a restricted area. In the case of certain airless-type machines, such as Tumblasts, this disadvantage is overcome by the fact that the castings are on a moving bed arranged in such a way as to cause the castings to be constantly turned over.

In the case of airless-type machines where the casting, once placed, remains in a fixed position, two or three impellers are necessary so that the casting presents all its sides to one or other of the impellers. Considerable development of airless-type shot-blast plants has been made in the past few years, and a few of the various types made are as follow:—(i) Tumblast; (ii) 19-ft. dia. turntable; (iii) suspended hooks, travelling on endless chains, and (iv) 6-ft. dia. swing turntable and conveyor type. Figs. 12 to 16 illustrate the various types of plant mentioned, and these illustrations are self-explanatory.

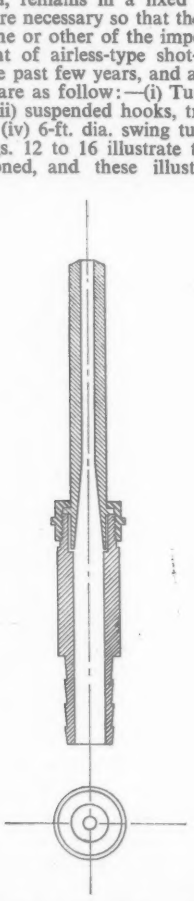

FIG. 10.—SECTIONAL ARRANGEMENT OF CAST-IRON NOZZLE FOR SHOT-BLAST PLANT.

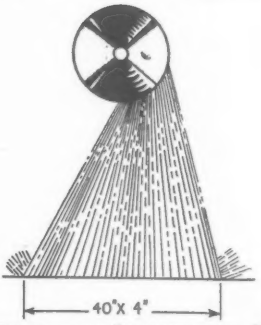

FIG. 11.—DIAGRAM OF IMPELLER AND SHOT DISTRIBUTION. WHEELABRATOR, 12½ H.P. ABSORBED.

One real advantage of the airless-type shot-blast plant is that it is not necessary for the operator to enter the shot-blast chamber. Great efforts have been, and are still being made, therefore, to widen the scope of airless cleaning, and considerable success has been achieved on large-casting plants designed to take specialised types of casting.

One important target in improving conditions for fettling-shop operators is the elimination of compressed-air shot-blast plants, and, as the above discussion shows, in addition to improving fettling-shop conditions, much economy can result from the saving in compressed air which would result. In this matter, it would appear that a healthy state of competition can be fostered between two alternative processes to compressed air or shot-blasting, namely, the development of Hydro-Blasting or some similar wet process, or the development of airless cleaning. Let both these alternatives be encouraged to compete with each other in the knowledge that a healthy competition between the two is the most likely way of fostering the healthy development of both processes.

Some useful work was carried out by the North-East Coast Regional Technical Committee and the Lancashire and Yorkshire Region Technical Committee of the British Steel Founders' Association, in 1946 and 1947, on the engineering aspects of both compressed-air and airless shot-blast plants, and the reports[5,6] covering these investigations provide valuable and detailed information over and above what can be included in the form of the general survey, which this Paper presents.

(To be continued.)

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Do You Use Your Cost System?*

By Ralph L. Lee†

(*Continued from page* 272)

Wages Procedure—Cupola Department

A special wages ticket (Fig. 7) has been designed for reporting cupola production. The ticket will be pre-slotted with the operation number and employee clock number, and will be Addressograph-ed in advance with the employee's name and clock number. This refers to the name of the employee responsible for the cupola work. As will be noted, provision is made on the bottom of the ticket for the name of the labourer, whose name will be inserted on the ticket by the group leader. The tons of metal melted and time elapsed will be recorded on the ticket by the group leader, as well as the time worked by the labourer. In addition, it will be necessary for the labourer to make out a ticket on which will be shown the hours worked, which ticket will be used in the wages office to record his daily earnings, as computed on the cupola ticket.

WAGES-OFFICE PROCEDURE

When the daily production and day-work tickets are handed in to the wages office by the various foundry departments, they will be handled in the following manner:—

(1) The tickets will be reviewed to see that all of them are on hand according to the number of tickets reported by the foundry wages clerk as covering each employee's work for the day, and, also, to see that the date is shown on all tickets.

(2) The tickets will be punched *en bloc* to record the pay period.

(3) Production tickets on which the operation number has not been pre-slotted will be sorted out and slotted for the operation number. Such tickets will consist principally of cleaning-department tickets reporting operations on which the employee ordinarily is not engaged, and consequently for which the tickets had not been pre-slotted for operation number.

(4) Tickets will be manually sorted as to pattern number, and then taken to the pattern-price record, from which the standard pattern order number, and piece-work rates will be posted to the tickets. Having all tickets relating to a particular pattern number grouped together will facilitate the pricing thereof from the pattern record, and effect a saving of time as compared to the method previously employed.

(5) Wherever necessary the tickets will then be re-grouped according to standard pattern order number (which will in all cases identify the pattern number), and the tickets will be block punched for pattern order number. In this connection, it is intended that a pattern order number will be assigned to each new pattern as it is received and will apply to that particular pattern on all subsequent orders.

(6) After pricing and slotting of the standard pattern order number the tickets will be extended for gross earnings.

As it will be necessary to separate the tickets covering labour performed in the moulding department, both direct and indirect, from those relating to other departments, due to the fact that it will not be possible to compute the earnings on the moulding department production tickets until the scrap reports relating to the particular day's production have been handed in, it will be found advantageous to set them aside as the gross earnings are being extended.

(7) As the gross earnings are being extended, cleaning-department tickets on which extra operations are recorded, will be set aside and block-punched to identify them as tickets which will show labour losses.

The labour cost of extra operations and re-operations in the cleaning department, and the labour cost of broken moulds, "Company"-broken castings, and one-half the labour cost of "Company" welds in the mould department are considered labour losses due to defective work. These labour losses will be determined and set out daily on a special report for each department. However, with respect to moulding department tickets, information as to the firm's broken castings and welds will be slotted to identify them as labour-loss tickets, and the daily labour-loss report will be prepared.

Wages Office Procedures for Labour Tickets other than those of the Moulding Section

1. The amount of earnings should be computed and recorded on each ticket.

2. The tickets should be added to establish a control total on the wages for the day, and recorded on a "Summary of Wages and Labour Distribution." Only the total will be recorded at this time which will serve as a control for the subsequent distribution of labour according to the various classes thereof. As later described, the daily total here recorded and distributed will be equal to the amount of earnings recorded daily on the employees-earnings cards, from which the wages sheet will be prepared at the end of each week.

A "Summary of Wages and Labour Distribution" has been so designed that it will serve as a control on the total accumulated wages each day, distributed according to labour classification in each department. It will provide a ready summary of labour costs, and the distribution thereof, for each week which will act as a control amount on the wages which will be paid for that week, and, also will provide a basis for distribution of labour at the end of each accounting period. In addition to this, the summary will also furnish the basis from which will be obtained a

*Presented at the London Conference of the Institute of British Foundrymen, June, 1948.

† Secretary-Treasurer, Grede Foundries, Inc., Milwaukee, Wisc. U.S.A., also Chairman, A.F.A. Foundry Cost Committee.

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periodic control total for the accumulation of labour costs according to pattern number, as well as a daily control total of the labour losses as analysed and reported by the daily departmental labour-loss reports.

3. From the cleaning department tickets on which extra operations are shown, and which have been set apart at the time they were priced and extended, there will be prepared a statement, in triplicate, showing the total of such extra labour costs by pattern number, operation, and the department responsible for the loss.

The original of this daily "departmental labour-loss" report will be furnished to the foundry superintendent; the duplicate thereof should be retained in the foundry office files, and the triplicate forwarded to the general accounting department. As the information contained in this report is of vital importance to the foundry superintendent, every effort should be made to supply this information as soon as possible. It should be an established rule that this report be completed immediately after the tickets have been priced and extended, and the extra-operation cards sorted out and controlled.

This daily "departmental labour loss" report will show the amount of the loss for which each department has been responsible and the pattern numbers on which the loss was incurred. A daily total of the total loss chargeable to each department will be obtained and recorded. This daily total should be added to the accumulated total for the period to date as shown on the previous day's report, so that a current total for the period to date is shown in each daily report. At the end of the period, the accumulated total of labour loss chargeable to each department, as shown by the report for the last day of the period, will serve as the basis for posting the schedule entry which will credit the total labour-loss account and charge an appropriate departmental labour-loss variation amount for that portion of the labour loss for which the department was responsible.

The foregoing daily report of labour losses due to extra operations and re-operations will not include the labour losses of the moulding section as a result of scrap moulds. A separate report will be prepared for this item.

4. A daily labour distribution will be prepared and posted to the "summary of wages and labour distribution," under the appropriate headings. To facilitate the preparation of this, distribution of the tickets will be key-sorted by operations and arranged in operation number sequence. This will permit of a total of the tickets for each operation being readily prepared. The total of all operations, except those of the moulding department, posted as above noted, must be equal to the control total recorded on the "summary of wages and labour distribution chart," immediately upon completion of the pricing and extension of the tickets.

The daily distribution of labour will not include overtime, or special allowances, as the amounts thereof will not be determinable until the end of the weekly pay period. These allowances will be made, using as a basis the average hourly rate developed for the current weekly wages sheet, and will be included with the tickets for the last day of the current week.

Before describing further procedures which are to be followed and operations that are to be performed on the labour tickets described in this section, the special procedures relating to labour tickets of the moulding department will be outlined up to that point at which procedures are identical for labour tickets for all departments.

Wages Office Procedures for Moulding Section Labour Tickets

In preceding paragraphs were described the operations that are to be performed on the moulding section tickets up to the point of insertion of the piece-work rates on the tickets. At that point the moulding department tickets were set aside, due to the fact that earnings thereon could not be calculated, as "good production" was not recorded and could not be recorded until after scrap reports for the day were received from the foundry.

The moulding section tickets, that have been segregated in the above manner will be subject to the following procedures:—

(1) The tickets will be sorted so as to place them in numerical order as to employee number. All of the tickets for the day will be kept intact pending the completion by the inspector of the related scrap reports.

(2) When the scrap reports covering the day's production are handed in to the wages office they will be matched with the related production tickets, and the information shown on the scrap reports transferred to the tickets. When this is accomplished the tickets will contain a complete record of gross production, and net production on which earnings are to be computed, as well as a detailed record of the scrap produced.

(3) After the information shown on the scrap reports has been transferred to the tickets covering the production for the day, the scrap reports will be returned to the foundry, where they will be handed over to the respective employees to furnish them with a record of their net production.

It is important that all information appearing on the scrap report be copied on to the production ticket, as otherwise the wages and cost departments will not possess a complete record of production which will be necessary in the event of a query on the part of an employee as to the amount of his earnings.

(4) The wages amount should now be extended on each ticket. In addition to the determination of the mould amount, this may also involve a calculation of earnings for moulds poured (if the moulder has poured his own moulds) as well as a calculation of earnings on account of pattern changes, which pattern changes will be collected and shown on one ticket for each moulder.

In addition to the foregoing, the amount of shake-out labour will be computed on each production ticket, but will not be added to the employee's earnings shown on the ticket.

(5) Next will be totalled the amount of shake-out labour earnings due to members of the shake-out group,

as shown on production tickets, and the total earnings will be distributed to individual shake-out crew tickets.

(6) Sandslinger moulding group earnings as shown on master tickets will be allocated to individual Sandslinger moulding crew tickets.

Shake-out and Sandslinger mouldings are group operations and the total of all earnings for the day as shown on the production tickets will be divided between the individual crew members on the basis of hours worked. An individual ticket will be filed by each employee who performs any shake-out labour or is engaged in Sandslinger moulding operations. The time spent by each employee on these operations will have been entered thereon by the foundry wages clerk.

The total of earnings due to shake-out crew members having been obtained, the hours shown on the individual shake-out labour crew tickets will be added up and the total earnings will be divided by the total hours to arrive at an average hourly rate. This average rate will be applied to the hours worked by each crew member and the earnings as computed will be entered on the ticket. For example, if the total shake-out earnings for the day amounted to $15.00 and was earned by the shake-out crew consisting of five members who worked a total of 20 hours, the computation would be made as follows:—

Total earnings, $15.00; total hours, 20; average hourly rate, $0.75.

Employee.	Hours employed.	Dollar earnings at average rate.
A	7	5.25
B	5	3.75
C	4	3.00
D	2	1.50
E	2	1.50
	20	15.00

The total earnings of the Sandslinger moulding crew will be obtained from the master tickets covering the production on each pattern by the crew. These earnings will then be distributed among the various crew members on the basis of the hours worked by each, as shown on the daily ticket handed in by each individual crew member. The manner of computation and distribution of the earnings of each crew member will be identical with that described above for earnings of the shake-out crew members.

(7) The tickets will next be added to establish a control on the mould department wages sheet for the day, and the control total will be recorded on the "summary of payroll and labour distribution chart."

The "payroll and labour distribution" here referred to is described in a foregoing section devoted to procedures relating to labour tickets for departments other than the moulding department. The manner of recording the control total and distribution will be the same as provided for in that section. The total of the moulding department tickets as daily recorded on this summary will be equal to the amount of earnings posted to the employees' earnings cards, from which the wages sheet will be prepared at the end of each week.

(8) Tickets showing labour losses will be sorted which will comprise all tickets which include earnings for broken moulds, "firm's" broken moulds, and "firm's" welds, and a statement showing the total of such labour losses by pattern number under each reason will be prepared.

In this connection, the labour loss to be shown for "firm's" welds is one-half the labour cost thereof and not the entire amount, which will serve to put such welds on the same basis as "moulder" welds for labour statistical purposes. The foregoing daily report on labour losses in the moulding department will be in addition to the daily report of labour losses in the cleaning department, previously described.

(9) A daily labour distribution may next be prepared. This will be posted to the "summary of payroll and labour distribution," under the appropriate headings, in the same manner as provided for tickets of departments other than the moulding department, fully described in a foregoing section.

As in the case of the labour distribution relating to the other departments, the moulding department labour distribution will also only include overtime and special allowance on a weekly basis, for the reasons previously stated. Labour losses in the moulding department will be charged to a special account, to be cleared at the end of the month by posting to appropriate departmental labour-loss variable accounts, based on the information shown on the daily reports of labour losses.

Additional Procedures on Labour Tickets of All Departments

The following procedures apply to the labour tickets of all departments, including the moulding department. After the daily labour distribution has been prepared, the labour tickets will be sorted by employee number in order to group together all of the tickets for each employee for the day. The time and earnings segregated as to "piece-work," "day-work," and "overtime" for each employee for the day will then be posted to a "daily wages summary" ticket which will be maintained for each employee during each pay period. The foundry wages clerk will have previously recorded the total number of hours worked and the total number of tickets for each day. Therefore the total hours as now posted will balance with the original hours as entered by the foundry timekeeper, and the earnings for all employees will balance with the total earnings as controlled through the "summary of payroll and labour distribution."

In the cleaning department, where employees are not required to report the time spent on productive operations, the hours spent on piece-work will be determined by deducting day-work hours, if any, from the total hours. After the time and earnings of all employees have been summarised in the above manner, the total earnings shown on each employee's summary will be computed, and compared with the wages sheet control previously established for the day.

At the end of the wages period the "daily wages summary" ticket will be computed and balanced to arrive at the total of the employees' earnings for the period. A grand total of all employees' earnings will

Foundry Cost System

be obtained and balanced with the grand total of earnings for the wages period as shown by the "summary of wages and labour distribution," after which the tickets will be forwarded, together with the adding-machine tape showing the grand total of the tickets, to the general accounting department for preparation of wages slips.

After wages slips have been written and the "daily wages summary" tickets returned, they will be matched with the related attendance cards of the employees. The two cards should be clipped together and permanently filed, arranged according to employee number sequence in each wages period. After the individual employee's labour tickets have been retained for a sufficient length of time, they should be sorted by pattern order number and grouped with like tickets relating to the same pattern order number already established for previous wages periods. Subsequently where the particular order is completed and despatched, the production tickets relating thereto will be used to collect certain labour cost data, as described under "summary of labour loss on completed castings."

PROCEDURE FOR COMPUTING LABOUR LOSS ON COMPLETED CASTINGS

As already explained the labour tickets will be filed by pattern order number after the wages sheet for the week has been prepared. This file of production labour tickets will be maintained in the general accounting department, and refers to production tickets covering the following direct labour operations:—

Name of operation.	Operation number.
Moulding Department—Moulding	5
Sandslinger Department—Moulding	11
Core Department—Makers	15
Core Department—Pasters	16
Cleaning Department—Mill and tumble ..	21
" " Sand blast	22
" " Scale	23
" " Grind	24
" " Chip	25
" " Test	27

The above operations do not cover all of the direct-labour operations involved in the making of castings, but cover by far the major part of the direct labour expended which can be readily controlled for cost purposes. The direct-labour operations which will not be controlled for cost purposes include cupola labour, pouring and shake-out labour of the moulding and Sandslinger departments, and inspection and despatch labour of the cleaning department. It will be noted that the direct labour operations not to be controlled for cost purposes are negligible in amount and will in no way interfere with the efficient control of foundry operations according to pattern numbers.

The purpose of instituting a cost-control procedure is to determine and report to the foundry and general managements the amount of direct labour on major operations incurred in the production of castings in excess of the standard direct labour of those operations included in the cost estimate of the castings. The amount of the excess direct labour expended on the production of castings will be determined exclusive of the moulding and cleaning departments' direct labour losses on broken moulds and defective castings. As previously commented upon under the caption of "Wages Office Procedures," this latter group of labour losses will be reported daily by the wages office for management control.

The production tickets, covering operations to be controlled for cost purposes, will remain in the wages office files, by employee number, until sufficient time has elapsed to allow foundry employees to complete the computation of earnings for the week covered by those production tickets. When this time has elapsed, the production tickets will be removed from the foundry wages files and forwarded to the general accounting department for costing purposes.

The general accounting department will establish a memorandum control record of production tickets for the operations named at the forepart of this section. The amount to be charged to the control record will be the total of the labour distribution for the week covered by the production tickets for operations 5, 11, 15, 16, 21, 22, 23, 24, 25, and 27. Charges to this memorandum control record will be made weekly—one charge for each weekly wages distribution period.

The production tickets charged to the control record will be filed according to the standard pattern order number. Production tickets for succeeding weeks will be sorted into the file by standard pattern order number, but it will not be necessary to sort the tickets in the file by labour operation numbers.

When the work on a particular pattern has been completed in the foundry and the casting despatched to the customer, the production tickets relating thereto will be used to develop the labour-loss statistics by operations for the pattern in the manner and for the purpose set forth in the subsequent comments. To repeat, the tickets are already in pattern order number, the only additional operation required being to sort the tickets relating to the pattern in order to group them by labour operations, according to the various labour operation numbers slotted on the border of the tickets.

When a foundry order has been completed, the producing foundry will send a copy of its completed foundry order, on which has been recorded the total number of castings despatched and invoiced, to the general accounting department. The receipt of the completed foundry order by the general accounting department will be the basis for the removal of all labour production tickets for that particular pattern from the cost file.

The production tickets for each standard pattern order number should be sorted according to labour operation numbers and, in the case of moulding operation No. 5 and Sandslinger operation No. 11, the total number of moulds paid for shall be determined from the tickets and a subtraction from that amount should be made representing the number of defective moulds given by the labour losses noted on the production ticket by the wages office. The net production of the moulding and Sandslinger departments and the gross

production of the core and cleaning departments shall be recorded on the three-part form designed to accumulate the labour losses of completed patterns by major direct labour operations. The information necessary to record the costing of a completed casting will require a single-line entry on this form.

The labour loss by operations will be arrived at by ascertaining the differences between the quantities reported as produced at each operation and the quantities despatched (after giving effect to the scrap allowance provided in the estimate) and extending such differences at the established piece-work rates for the various operations.

The total labour paid for the operations controlled under this procedure will be determined by computing the quantities reported as produced at each operation and recorded on the form, at the established piecework rates for the related operations. The total of the direct labour for the labour operations being controlled should be recorded on the form, and that amount will be the basis for crediting the memorandum control record for production tickets removed from the file and costed. In addition to entering on this record the labour losses as determined through the previously-mentioned procedures, the total of the labour losses due to defective castings reported earlier to the management for daily control purposes should be collected and summarised on this report in the following manner. The labour cost of defective work will be shown daily on a special report segregated as to pattern numbers, operations, and cause of defectiveness, but that daily report will not reflect the collective labour loss of defective work for each pattern.

The production tickets for the labour losses in the moulding, Sandslinger and cleaning departments incurred by reason of defective castings, extra operations, and re-operations on castings have been slotted in the wages office in the space provided therefor. Accordingly, these production tickets can be readily removed from the rest of the production tickets by the patterns, and the total of the defective labour losses recorded on those tickets should be recorded on the labour summary in the space provided.

Labour Summary

The labour summary of completed casting orders will include the following information, which will be recorded on the form in a one-line entry for each pattern:

Pattern number.

Mould—Pieces produced;
labour losses.

Core—Pieces produced;
labour losses.

Mill—Pieces produced;
labour losses.

Sand blast—Pieces produced;
labour losses.

Scale—Pieces produced;
labour losses.

Grind—Pieces produced;
labour losses.

Chip—Pieces produced;
labour losses.

Test—Pieces produced;
labour losses.

Total loss.

Labour loss—Defective castings.

Total labour loss.

Total labour cost.

Pieces despatched.

The original of this summary will be forwarded to the foundry management for study and guidance in the continued operation of the foundries. Several situations requiring foundry attention may be disclosed through this report. For instance, a number of castings may be scrapped in the various labour operations for which no report is made. A record of excessive scrap may, upon investigation, be found to report a normal condition in respect of a particular pattern due to the requirements peculiar to such pattern. Also, castings may be paid for at the various labour operations in excess of the number of castings which could possibly have been worked on at those operations. If the labour loss is substantial in amount and subsequent methods of production will not reduce or eliminate the labour loss, it may be necessary to revise the standard cost estimate of the casting, which may necessitate an upward revision in the selling price of the casting. The summary will, however, provide the foundry and general managements with sound, reliable data, which may be used in efficiently controlling labour costs in excess of the standard allowances made for them on the estimate cost sheet.

The summary-forms recording the labour losses on completed casting orders should be numbered and the totals on the forms should be forwarded to obtain the total labour losses by operations for the four-week accounting period. The information recorded on the summary sheets of completed casting orders should be recorded for permanent historical reference on to a permanent record by patterns, preferably on to that listing the following information:—

Labour loss report number;
Labour loss;
Labour loss—defective work;
Total labour loss;
Total labour cost.

If this information be recorded on the pattern record, it will provide the means of reviewing foundry experience on previous casting orders, which should prove helpful in effectively controlling the labour cost of the current casting order.

[At the London Conference of the Institute of British Foundrymen, held in June, the above Paper was presented in summary form by Mr. V. Delport on behalf of the Author. The Chairman, Mr. D. H. Wood, then opened the meeting for discussion.]

DISCUSSION

MR. KIRKHAM said it was very easy to criticise cost systems, but he thought in Mr. Lee's Paper they had a very clear example of obtaining the data, which he

Foundry Cost System—Discussion

deemed to be exceptionally good but which, in his opinion, was very unreliable from the point of view that the whole of the figures were compiled from information submitted by individual operators. This, in his experience, had proved fatal. He was sure that Mr. Lee, if he had been present, would have been able to tell them how he suggested that difficulty was overcome in America. In this country he found that, if one relied on the core-maker, the moulder, or whoever they might have in the foundry, to write out their own production dockets, they did not get very accurate results because, if the operative were on piece work, not only did he write out the direct labour dockets on piece work, but also the on-cost dockets and overhead dockets. He thought the human element in the foundry industry was such that, if they were producing a job and found they could not make it pay, they would sink some of it in overheads. His answer to that was that, obviously, they were relying entirely on the foreman to keep his eye on that type of booking. Personally, he thought that was the wrong duty for the foreman. He should have his time cut down to a minimum on clerical work and that should be the responsibility of the rate-fixing department.

Responsibility for Recording Information

A MEMBER said he could not too strongly emphasise the last speaker's point. He was surprised to find it was American practice to allow the men in the shops to do any clerical work. Thirty years ago he was a shop clerk in a very large American organisation and had a shop of 250 employees. In that shop no employee was allowed to touch a paper with his pencil. His experience from the costing point of view had been a very sorry one where employees in the shop were permitted to send up data to the cost department, either directly or indirectly. He felt it was not their responsibility and believed he was correct in saying that the feeling of the meeting would be with him on that point.

In an early paragraph of the Paper it was suggested that the "costs" should be known in a day or so, so that corrections could be made while the job was running. That must apply, surely, to long repetition runs. If the casting were in a process of manufacture which might take a fortnight or so, and then that same type of casting would perhaps not be made again for some months to come, it was very little use telling the management a day or so after the casting had been made that that particular casting had gone wrong.

MR. J. E. SPEAR said that his opinion of the employee's recording information was the same as that of the previous speaker and, judging from the class of labour which the American foundries had available, he would have thought that they would have even more trouble there than is the case here when workmen are asked to fill in documents. There had been a great deal of criticism by the Americans, of late, of the cost of British management, but, judging from the system described in this Paper, it seemed to him that the cost of management of an American foundry using that system would be considerably in excess of the cost of management of an equivalent British foundry.

MR. F. MURRAY said, after considerable experience in a mass-production foundry, when he viewed the document that the man had to fill up, he wondered what condition those sheets would be in at the end of the day. His experience had been that, if they asked a man to sign a sheet for anything, they got more sand and sweat than anything else. He did not know how the wages office was going to go on with those sheets. He was sorry that the Author was not present to answer questions, because one felt that he would have been able to deal with this and other questions raised in different parts of the Paper. It was possible he might have overcome the various objections raised, though he himself could not see how they could easily be surmounted.

A MEMBER said he presumed Mr. Lee must be attached to a steel foundry. In his notes he mentioned the cost of welding and re-welding. Surely cast iron founders did not like to record that welding had been done on any casting?

MR. DELPORT mentioned that in the opening paragraph of the Paper Mr. Lee referred to a large grey-iron foundry, but he believed that the foundry in which Mr. Lee was concerned made both grey-iron and steel castings.

The CHAIRMAN, Mr. D. H. Wood, expressed his thanks to Mr. Lee for sending the Paper, and to Mr. Delport for the time he had given to the study of the Paper and for the way in which he had presented it. He then closed the meeting.

Publication Received

Wiggin Electrical Handbook, Published by Henry Wiggin & Company, Limited, Wiggin Street, Birmingham, 16.

Some years before the war, this company produced a handbook under the title of "Electrical Resistance Materials." The popularity of this book was maintained over a long period, but with the end of the war many factors demanded its complete revision. Improvements in the methods of production rendered many of the figures in the old edition obsolete and many people in the electrical industry were anxious that the book should be made of wider interest. The new edition contains, in addition to data on electrical resistance materials, much useful information on such subjects as nickel-iron alloys, temperature control materials, thermostatic bimetals and high temperature alloys.

The list of conversions and mathematical data has been revised and extended. Current carrying capacity is presented as a nomogram and there is a useful section on springs. The nickel-chromium alloys are now known as the Brightray series, of which there are, at present, three main types. In the new method of classification the name "Glowray" has been replaced by "Brightray B." The looseleaf form has been retained, because it is hoped to add fresh or revised information as knowledge of these many alloys increases. The handbook will be supplied from Birmingham free of charge on receipt of a business card.

Notes from the Branches

National President Opens Birmingham Students' Section

Interest in the Students' Section of the Birmingham, Coventry & West Midlands Branch, I.B.F., brought together a company of about one hundred at the Chamber of Commerce, Birmingham, on September 8, for the first meeting of the new session. Mr. D. Marles (Chairman of the Section), presided, and all present heartily endorsed the welcome that he offered to Mr. R. B. Templeton, of Ealing Park Foundry, Limited, the President of the Institute.

The Chairman said that with the help of a live and enthusiastic Secretary and Committee the Section had made fairly good progress during the past session, and they were looking forward to what they hoped would be a successful and fruitful period ahead. Although to date they had added only twenty names to the membership roll of the Institute, the Section had made some impression in the district. He hoped that in the near future the Section would be able to make a contribution to the foundry industry as a whole by attracting all types of workers to the meetings, and by then giving them something of interest and value. They were gratified to see so many visitors, and were especially encouraged by the presence of Mr. Templeton, not only as a leading member of the industry but as the National President of the Institute. To visitors, as well as members, he appealed for support in making the programme of the Section known in their firms and colleges. The programme for the session included both lectures and works' visits. They were also pleased to have been entrusted with the task of organising the Short Paper competition which had been arranged by the Branch for a number of years. As the youngest Section of the Institute, its members must all make valiant efforts to ensure satisfactory progress, and to make a contribution which was not only spectacular but of real and lasting worth.

Two films were then shown. The first dealt with the manufacture of spun iron pipes, for which thanks were expressed to the Stanton Ironworks Company.

Mr. Templeton next introduced a film entitled "The Making of a Cast Crankshaft." He said it was a great pleasure to him to be present at the opening meeting of the session. He thought the large attendance augured well for the success of the programme that had been arranged. As to the film, he explained that the object in view was to give the public some idea of the importance of the foundry industry. Its appeal was more to the general public than to the foundry industry itself. The film showed a purely jobbing foundry, with no extensive mechanisation, and illustrated the method known as the vertical assembly of cores.

Proposing a vote of thanks to Mr. Templeton, Mr. W. M. Adamson, Vice-Chairman of the Section, said that ever since their formation they had received unstinted support from the senior Branch.

(*Concluded at foot of Col.* 2)

Mr. Dunn, in seconding, acknowledged the support given by Mr. Templeton and the Council of the Institute. They felt, he said, that in this development something had been started which could be applied in other Branches. Possibly in the not too distant future the progress made would be such that they would be running a students' annual national conference. The expression of thanks having been warmly accorded, Mr. Templeton replied, remarking that he would be happy to pay a second visit.

New Catalogues

Electric Induction Melting.—It is pleasing to see that Birlec Limited, of Tyburn Road, Erdington, Birmingham, 24, have chosen a sage green colour for the cover of their latest catalogue. It is a welcome change from the blue, red and orange, which nowadays appear so monotonously. Another novel notion has been the inclusion of half pages carrying line drawings, illustrating the paragraphs to their left and right. High-frequency induction furnaces, ranking amongst the neatest of melting plant, lend themselves admirably to the creation of an equally neat brochure and the fullest advantage has been taken of this fact. In keeping with the artistic presentation, proper attention has been given to the orderly marshalling of data and their illustration by pictures and tabular matter. It can be presumed that this publication is available to our readers, both on the ferrous and non-ferrous sides, on writing to the publicity department at Erdington.

Steel Castings and Gears. "The Works and Products of P. R. Jackson & Company, Limited" (Salford Works, Hampson Street, Manchester, 5) is the title of one of the "best dressed" pieces of trade literature received since the war. When a publication is "designed particularly to interest customers" the age of the concern issuing a brochure is not always an advantage. The legacy of old shops and time-honoured plant does not help the publicist. Yet here is a case of a works established in 1840, which so far as illustration is concerned shows but little trace of its antiquity. Moreover, by stressing the scientific control used throughout the works, the reader is left with the feeling that "technical progress" is the keynote of this concern. The binding is particularly attractive. It carries on a dark ultramarine background, a 3 in. bronze medallion inscribed "Jacksons of Manchester." For the embellishment of the illustrations a light greyish blue has been used. The first eighteen pages are devoted to the steel foundry and its productions, and just a slight slip-up has been made in the reproduction of the general view of the foundry, for clothing is shown hanging on the shop wall. A modicum of studio faking is called for where the photographer has failed to notice this blemish.

The gear section has space devoted to it of the same order as the steel castings, but it is reinforced by the addition of some 24 pages of technical data.

The reviewer congratulates those responsible for the production of this brochure. It is a real credit to the foundry industry.

Scottish Steel Industry Developments

Expenditure to Exceed £11,000,000

Mr. G. R. Strauss, Minister of Supply, has been visiting industrial undertakings in Central Scotland. He announced that development schemes had been approved for the Scottish steel industry exceeding £11,000,000, representing approximately one-third of the programme at present envisaged, while a very large number of schemes—48—involving expenditure of nearly £400,000, had also been approved for the modernisation and development of foundries. Many of the schemes were, in fact, already at an advanced stage of development.

He indicated that the work which had been so far approved would not have any effect on the final decision, which was still to be taken, as to the ultimate location of the steel industry in Scotland. The alternative schemes of development in the Clyde estuary and in inland estates were still under active consideration. He was hopeful that there might be a final recommendation on this matter well before the end of the year.

The Minister said that his department was responsible for about one-third of the manufacturing industries in Scotland, and, so far as he could see, the general situation was exceedingly good. There were something like 40 per cent. more people employed in the engineering industries than there were prior to the war, and most of them were getting on very well. In 1938, unemployment in Scotland was 232,000, whereas in July of this year it was below 54,000, the lowest that Scotland had ever known. Mr. Strauss agreed that engineering industries in the country were suffering from difficulties, and that greater output could be achieved if there was a better flow of materials, particularly some of the special steels.

They were doing all they could towards increasing production at home for the type of steels in short supply, and getting as many imports from abroad from whatever country they could, he said. The collection of steel scrap had increased enormously, and the last figures showed that Britain was obtaining something like 200,000 tons a week more than it did a year ago. It was hoped that that would bridge the gap until supplies were built up from other sources. By 1952, we should not require any imports of scrap. The present difficulties in scrap supplies were largely matters of purchase rather than transport so far as Germany was concerned, he said, but he expressed himself as optimistic that the supply would be maintained and even improved in the future.

FOUR MEN were taken to hospital recently suffering from burns after an accident at the works of the Ardeer Foundry Company, Limited, Stevenston, Ayrshire. The accident occurred while a ladle of molten metal was being carried by a crane. It is understood that a mishap caused the ladle to tip and that some of the molten metal spilled from it.

August Steel Output Record

Year's Production Rate Exceeds Target

Steel production last month attained an annual rate of 14,117,000 tons, which is the highest rate of output yet recorded for August. The previous highest for this month was reached in August of last year, the annual rate then being 12,179,000 tons. The output of last month is all the more gratifying in view of the fact that holidays interfered with production in the early part of the month. The holiday season is now over, and the rate of output for the year to date—14,650,000 tons—is in excess of the target rate of 14½ million tons. During the second part of August output was again fully back to the pre-holiday rate of over 15 million tons. Last month's rate of steel output compared with an annual rate of 12,084,000 tons in July.

Pig-iron production in August was at an annual rate of 9,048,000 tons, compared with 8,908,000 tons in July, and 7,657,000 tons a year ago.

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
1948—1st quarter ..	174,700	9,084,000	287,200	14,933,000
2nd quarter ..	182,000	9,464,000	294,700	15,323,000
July	171,300	8,908,000	232,400	12,084,000
August ..	174,000	9,048,000	271,500	14,117,000
1947—1st quarter ..	134,400	6,990,000	216,000	11,232,000
2nd quarter ..	141,600	7,362,000	244,100	12,694,000
July	143,500	7,460,000	211,700	11,008,000
August ..	147,200	7,657,000	234,200	12,179,000

News in Brief

PLANS HAVE BEEN APPROVED for the erection of a joiners' machine shop at the Pallion Engine Works of William Doxford & Sons, Limited, Sunderland.

FIRMS ENTIRELY ENGAGED on foundry work will be exempt from a compulsory electricity load-spreading scheme which will operate in the Midlands during the coming winter.

RECENT SHIPBUILDING ORDERS include two cargo liners of 7,770 tons dw. each for Sir James Laing & Sons, Limited, Sunderland; a 12,000-ton motorship for Swedish owners for Harland & Wolff, Limited, Belfast, and a cargo motorship for William Denny & Bros., Limited, for New Zealand owners.

THE ANGLO-SAXON PETROLEUM COMPANY, LIMITED, has ordered a new type of ship propulsion plant from the British Thomson-Houston Company, Limited, which is associated with the development of jet propulsion. It is stated that the intention is to try the new form of ship propulsion not with a view to increased speed, but to find out whether fuel economy could be effected. The engine—a 1,200-s.h.p. gas turbo-electric ship propulsion set—will replace one of the four Diesel units in the company's tanker Auris (8,200 tons).

Segregation of Hadfields

Three New Subsidiaries

The board of Hadfields, Limited, Sheffield, has decided that the time has now arrived for segregation of the undertaking into separate units. This announcement is made by the chairman of the company, Lord Dudley Gordon, in his statement for the extra ordinary meeting at Sheffield on September 30. Each unit will own its own land, buildings, plant and the like, and have its specialists "concentrating their energies on the development of its own particular products."

To achieve this, steps are being taken to create three new subsidiary companies (to operate from October 1), as follows:—

HADFIELDS STEELS.—This company will be responsible for the manufacture of steel of all kinds, including alloy and special steels, and will also operate the large and small rolling mills producing billets, blooms and bars.

HADFIELDS FORGINGS.—This company will continue to develop the activities of the forging departments, and when the new forge is completed still further substantial results are expected. Among other items, the production of forged steel rolls has been of outstanding importance and success, replacing in many instances the importation of such rolls.

HADFIELDS FOUNDRY & ENGINEERING.—Considerable development of the foundry is envisaged. Part has already been accomplished and will be continued under the new company.

Parent Company's Control

The segregation of the units, says the chairman, is an internal arrangement and the entire share capital of each company will be held by Hadfields, Limited, in like manner to the other subsidiaries already owned. The parent company—Hadfields—will continue to act as the selling organisation for the entire output of the new subsidiaries, and in selecting directors for such companies the opportunity can be taken to appoint not only directors of Hadfields, but also officials who are particularly concerned with the day-to-day manufacturing activities covered by each of the new subsidiaries. The board of Hadfields will continue to control all matters of policy of all the units comprising the complete group.

It is proposed to alter the accounting period of the Hadfields group of companies, and to close the financial year at September 30 in each year, commencing with 1948. By adoption of this altered date, the preparation of the annual accounts can be completed with less difficulty and disturbance to the normal working hours of the works and office personnel.

Lord Dudley Gordon says that the directors have been giving special consideration to the structure of the organisation so as to develop further the maximum efficiency in manufacture, economy in production and closer determination of cost. In addition, schemes have been approved by the board which, over the next five years, may result in an expenditure of over £4,000,000. The foundry is being reorganised, new plant being installed both as regards replacement and expansion of business. A new forge is to be built and equipped with up-to-date presses, together with heat-treatment and ancillary facilities. Both of the above schemes have received Governmental sanction.

The rights and privileges of the stockholders of Hadfields, Limited, says the chairman, will not be affected in any way whatsoever by the new proposals.

Liquidators for Richard Crittall Subsidiaries

A liquidator and a committee of inspection were nominated for Richard Crittall (Industrial Plant & Equipment), Limited, a subsidiary of Richard Crittall & Company, Limited, heating and ventilating engineers, of Brentford, Middx, at a recent meeting of creditors. Mr. W. V. Cozens, the newly-appointed chairman of the company and its parent company, said the "exceptionally bad management and a costing system not worth a damn" were the chief causes of the £242,977 deficit of Richard Crittall (Industrial Plant & Equipment), Limited, of Glasgow.

He said that when he went to the Glasgow factory on August 31 he realised within a few hours "there was no possible chance of retrieving the losses that were undoubtedly being incurred daily.

Creditors agreed to the appointment as liquidator of Mr. William Walker, of Peat, Marwick, Mitchell & Company, and a committee of management representing the larger trade creditors was set up. Mr. R. W. West, of Wake, West, Price & Company, is the liquidator for Richard Crittall (Research & Development), Limited.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained.

Bedlington, October 1—Supply of 4-in. cast-iron water mains and specials, etc., for the Urban District Council. Mr. W. Hall, engineer and surveyor, Council Offices, Bedlington.

Irlam, October 8—Supply of grates, etc., for 20 houses, for the Urban District Council. The Engineer and Surveyor, Council Offices, Irlam, near Manchester.

Louth—Supply and laying of about 700 yds. of 3-in. spun-iron mains, etc., for the Rural District Council. Mr. J. H. Haiste, consulting engineer, 4, Queen's Square, Woodhouse Lane, Leeds, 2. (Fee £2 2s., returnable.)

Market Harborough, October 12—Contract No. 2, supply of about 7 miles of 5-in., 4-in. and 3-in. dia. water mains; contract No. 3, supply of valves and fittings, etc., for the Rural District Council. Pick, Everard, Keay & Gimson, engineers, 6, Millstone Lane, Leicester.

Trowbridge, Wilts, October 1—Low-pressure hot-water heating, domestic hot-water supply and cold-water supply, for the Education Committee. Mr. F. I. Bowden, county architect, County Hall, Trowbridge. (Fee £2 2s., returnable.)

Engineers' Wage Award

Shop Stewards Recommend Rejection

A statement issued recently by the Shop Stewards' National Council of Engineering and Allied Trades recommends the rejection of the 5s. increase proposed by the recent Ministry of Labour's court of inquiry into the engineers' wage claim. This view is based on the findings of the court and the feelings in the workshops, says the statement.

Particular attention is drawn to the opinion of the court of inquiry that ". . . no future claim in the engineering industry would be admissible which could not be justified within the four corners of the White Paper." The Council claims that this makes it clear that if the 5s. is accepted they are committed to the present level of wages for years ahead, a level which leaves thousands of engineering workers below a subsistence standard, as was proved by the union spokesman to the court. The statement adds that the Confederation of Shipbuilding and Engineering Unions of the United Kingdom presented figures which proved that since 1946 the cost of living had increased by 3s. in the £. Representative engineering firms showed an increase in net profits in 1948 of 80 per cent. over 1947 and output a head in the past two years was up by 23 per cent., while wages had remained pegged. Consequently, the Council repeats the demand made in June for the claim in full from the date of application, February, 1948.

It is suggested that shop stewards should take steps so that the workers, by mass demonstrations and resolutions, can make it clear to the unions that they are determined to win their modest claim for 13s. and consolidation.

"We shall win if, in each area, the workers show that they are firmly resolved to accept nothing less than the full claim. We support the call for mass demonstrations, coming from several districts, on September 20, the day before the meeting between the unions and the employers," says the statement.

Boycott of Anglo-American Council

Concerning a second resolution, dealing with production efficiency, it is stated that the proposed Anglo-American Council to discuss production is viewed with profound distrust, and engineering workers are asked to urge their unions to boycott it. Expressing surprise that Sir Stafford Cripps had taken the initiative in this matter, the statement gives insistence on out-dated managerial functions, the refusal to give joint production committees real powers, too high a ration of managerial drones to productive workers, and the failure to ensure increased rewards for increased efforts as some of the hindrances to all-out production to which Sir Stafford might usefully give his attention.

The lack of a comprehensive plan for the engineering industry, which was demanded by the unions over two years ago, is, in the Council's opinion, one of the biggest factors hindering increased output.

Steel Company of Wales

Allotment of Shares

Allotment was made recently of 7,924,541 fully-paid £1 ordinary shares in the Steel Company of Wales, Limited, to the four founder companies in payment for the fixed assets transferred by them on September 27, 1947, and the valuation of which has now been made by Sir Andrew Macharg, as stated in the prospectus of July 14, 1947. The total value of the assets, together with the working capital transferred with the undertakings, for which shares have already been allotted, is in excess of £10 million, as anticipated by Sir Andrew and stated in the prospectus, and, in fact, amounts to £11,934,541.

The total issued share capital of the company is now £16,936,041. It was registered in 1947 with a capital of £40,000,000. The four founder companies who transferred various sections of their existing undertakings to the Steel Company of Wales in September, 1947, were Richard Thomas & Baldwins, Limited, Guest Keen Baldwins Iron & Steel, Limited, John Lysaght, Limited, and Llanelly Associated Tinplate Companies, Limited.

Engineering and Marine Exhibition

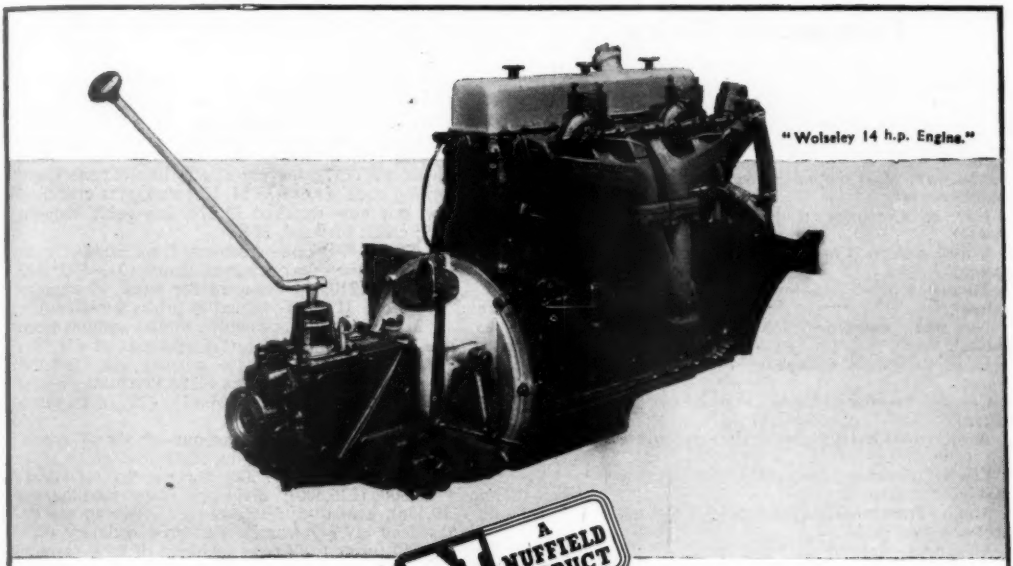
The office of honorary president of the 16th Engineering and Marine Exhibition, which is to be held at Olympia, London, from August 25 to September 10, 1949, is to be filled by Sir John Anderson, P.C., F.R.S., M.P. for the Scottish Universities. Sir John is chairman of the Port of London Authority.

The whole of the premises of Olympia has been reserved for the exhibition. The additional use of the Empire Hall will allow a 20-25 per cent. increase on space occupied by exhibits in 1947 and enable over 600 manufacturers to display their latest products. The Engineering and Marine Exhibition has been held biennially since 1906, except for the interruptions caused by war. It is the largest exhibition solely devoted to the display of engineering manufactures in the world and in 1947 attracted an attendance of over 140,000, including visitors from every continent.

A.E.U. Warns Against Strikes

The Executive Council of the Amalgamated Engineering Union has issued a warning against unofficial stoppages of work. In a letter circulated to all branch secretaries last week, it pointed out that "the Executive Council decided to issue the strongest possible warning that calls for unofficial stoppage of work made by shop stewards and/or district committees would not be tolerated. Such action did not constitute a challenge to the employers, but to the authority of the district committee, national committee, and executive council."

SWANSEA CORPORATION has approved plans for extensions to the Lower Forest Foundry, Morriston, of Unifloc Reagents, Limited.



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REFINED PIG IRON

USED AND RECOMMENDED
FOR ALL HIGH-DUTY
ENGINEERING CASTINGS

THE STANTON IRONWORKS COMPANY LIMITED, Nr. NOTTINGHAM

Company News

(Figures for previous year in brackets.)

Aberdare Cables—Interim dividend of 6% (same).

Tipper Industries—Interim dividend of 7½% (same).

Wm. Dibben & Sons—Interim dividend of 5% (nil).

Cowans, Sheldon & Company—Dividend of 15% (same).

Mellowes & Company—Interim dividend of 10% (same).

Kay & Company (Engineers)—Dividend of 20% (same).

Coltness Iron Company—Interim dividend of 5% (same).

Thomas Robinson & Son—Interim dividend of 2½% (same).

Newman Industries—Interim dividend of 7½% (same).

C. A. Parsons & Company—Interim dividend of 5% (same).

Crossley-Premier Engines—Dividend of 12½% (same).

Associated Electrical Industries—Interim dividend of 5% (same).

Electric Furnace Company—Final dividend of 4½%, making 8% (same).

Metal Traders—First and final dividend of 250% (same in two dividends).

Alexander Stephen & Sons—Final dividend of 8% and bonus of 3%, making 18% (same).

Bristol Industries—Profit for the year to March 31, after taxation, depreciation, etc., £49,402 (£43,236); dividend of 15 per cent. (same); to general reserve, £10,000 (same); reserve stock contingencies, £10,000 (nil); forward, £23,238 (£17,653).

William Neill & Son (St. Helens)—Net profit to March 31, £80,710 (£63,149); to taxation, £40,312 (£37,000); exceptional depreciation reserve, £3,781 (£593); staff pension fund, £4,536 (£7,250); general reserve, £10,000 (nil); dividend of 25% (same); forward, £31,568 (£20,487).

Christy Bros. & Company—Ordinary dividend of 17½% for the year ended March 31. It is stated that the permitted dividend is restricted to 17½% under the Electricity Act, 1947, and the distribution, therefore, has to be regarded as a final payment of dividend in respect of the security. For each of the four previous years a dividend of 17½% was paid.

Fishers Foils—Trading profit to April 30, £45,024 (£35,392); fees, £17 (£25); investment interest, £2,846 (£3,247); rent, £428 (£97); to directors' remuneration, £950 (same); tax, £20,942 (£16,484); depreciation, £10,595 (£9,635); net profit, £15,828 (£12,018); to general reserve, £10,000 (nil); staff insurance reserve, £3,000 (nil); special depreciation reserve, nil (£10,000); dividend of 5% (same); forward, £7,686 (£7,608).

Smith, Patterson & Company—Consolidated trading profit for 1947, £127,612; other income, £1,900; parent company's trading profit, £113,582; other income, £1,682; to depreciation, £2,625; interest, £33; directors' fees, £680; auditor's remuneration, £275; capital issue expenses, £754; profits tax, £20,000; income tax, £40,000; general reserve, £34,570; dividend of 25%, £15,813; forward, £6,742 (£6,228). The company was made public in October, 1947.

Steel Ceilings—Trading profit for 1947, £5,616 (£70); fees, £57 (£97); patent sale, nil (£20); to general charges, etc., £3,512 (£1,572); directors' fees, £700 (£75); depreciation, £3,067 (£813); shareholders' investigation, nil (£160); land option written off, nil (£59); war damage adjustment, nil (£57); leaving £1,606 loss (£2,549 loss); after writing back, £1,617 *re* M. Heyman, plus creditors' provision not now required £2,678, less debit brought in £2,549; credit forward, £140.

Beralt Tin & Wolfram—Proceeds from sales of concentrates for the year ended March 31, £973,512 (£74,789), less £210,858 deducted for stock of concentrates at March 31, 1947, valued at prices subsequently realised; in the previous accounts a similar amount from the same source was added to the proceeds of £74,789; profit, £356,917 (£108,123); to current tax, £68,150 (£48,050); reserve for future tax, £154,500 (nil); general reserve, £50,000 (nil); dividend of 45% (25%); forward, £46,789 (£44,445).

Fairbairn Lawson Combe Barbour—Profit of group, £86,653 (£58,953); brought in, £306,096 (£205,165); over-provided tax, nil £23,500); income tax on allowances, £5,600 (£26,500); dividends from subsidiaries, nil (£19,586); available, £398,349 (£333,704); to preference dividend, £9,747 (same); preferred ordinary dividend, £8,250 (same); ordinary dividend of 35% (same); lent on doubled capital, £19,223 (£9,611); general reserve, £234,500 (nil); dividend equalisation reserve, £25,000 (nil); forward by parent company, £101,629.

Fisher & Ludlow—Consolidated trading profit, £386,768 (£412,844); other income, £538 (£2,803); to depreciation, £128,254 (£116,897); directors: remuneration, £6,541 (£8,049), other emoluments, £14,391 (£13,718); income tax, £64,500 (£96,300); profits tax, £43,800 (£14,700); initial taxation relief transferred to suspense, £20,000 (£24,000); net profit, £109,820 (£141,983); to preference dividends, £19,375 (£19,036); ordinary dividend of 20% (same); staff fund, £2,000 (£5,000); forward: Fisher & Ludlow, £239,645 (£217,200), subsidiary, £3,451 (same).

Saunders Valve Company—Net profit for the year to April 30, including the net profit of the subsidiary company, £85,327. Of this amount £55,114 relates to the period of eight months prior to incorporation on December 30, 1947, and after making a provision of £40,000 for the relevant taxation, the balance of £15,114 is being capitalised. The remaining net profit is £30,213; to provision for taxation, £8,300; reserve for future income tax, £8.700; amount of the net profit of the subsidiary company retained therein, £587; dividend of 5%, already paid, £6,875; forward, £5,751.

AS A RESULT of an accident at the Acklam Works of Dorman, Long & Company, Limited, seven men were injured on September 12—six of them being detained in hospital in a serious condition. The company stated that the men were engaged on the repair of the stack of a blast furnace when, owing to the canting of a staging, they fell a distance of about 30 ft.

WORKINGTON FOUNDRY IRONS

THE UNITED STEEL COMPANIES LTD

Workington Irons, made from particularly pure hematite ores, are esteemed by foundrymen for admixture with other irons to improve the quality and physical properties, especially for ingot mould castings, machine castings, chemical plant, etc. All Workington irons are supplied in machine-cast form, free from sand, saving coke in the cupola, and being most convenient for handling and mixing.

WORKINGTON IRON & STEEL COMPANY

WORKINGTON Telephone: Workington 206 Telegrams: "Mosbay," Workington CUMBERLAND

Branch of The United Steel Companies Limited.

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Raw Material Markets

Iron and Steel

There is an enormous volume of orders on hand in the foundry industry, but the present allocations of pig-iron are inadequate fully to meet all needs. Hematite production has been expanded by the lighting up of another blast furnace, but supplies have not yet caught up with requirements. It is hoped that foundry iron production will be stepped up before long; the authorities are at present going into the question and it is believed that there will be developments as soon as a regular flow of raw materials can be assured, together with additional labour.

With increased export quotas in hand, as well as an overwhelming volume of orders for the home market, re-rollers still find their activities restricted by the shortage of steel semis. Especially urgent is the need for billets under 3 in., and there is also a big unsatisfied demand for sheet bars. During the past few weeks there has been some acceleration of deliveries from home sources, and it is hoped that supplies from Belgium will soon be flowing more freely.

The plate and section mills are being operated at very nearly capacity limits, but the heavy output figures are still unequal to the demand. Shipbuilders could certainly turn out new tonnage much more rapidly if their steel quotas could be increased and the same limiting factor operates in the engineering and motor industries. Somewhat heavier tonnages of rails have been allocated for shipment to the Colonies, but the total exports of sheets represent only a small fraction of the overseas business which is offered.

Non-ferrous Metals

It will be remembered that the July copper statistics for the United Kingdom were not particularly exciting so far as consumption was concerned, and the general expectation is that the details for August, when they make their appearance, will be no better than July—if as good. In the United States, however, in spite of checks to industrial activity caused by a spell of extreme heat in that country, August made an excellent showing. Production of crude copper for the month amounted to 88,496 short tons, an increase of more than 7,000 tons on the July total. In contrast to this, the output of refined copper fell somewhat, from 107,014 tons in July to 102,798 tons in August. Domestic deliveries were about a couple of thousand tons down on July at 106,407 tons, while stocks of refined metal increased from 80,469 tons at July 31 to 81,946 tons at the end of August. All things considered, these figures must be regarded as extremely good and auguring very well for the rest of the year. In the heyday of industrial activity there is no gainsaying the fact that the United States is a country of most astonishing possibilities, but the cool calculation of the experienced market observer cannot but take stock of the situation across the Atlantic and consider what may befall in due course. Reactions are awkward things to deal with, and, although deferred sometimes for an inconceivably long time, they always come sooner or later. What is to be the aftermath of this astonishing absorption of copper and zinc into the manufacturing system of the United States?

In every copper mine in the world output is being stretched to the utmost, for, despite the fact that production costs are up quite a lot compared with pre-war days, the present price of 23½ cents ensures a remarkably fine profit to the producers. It is surprising that plans are being laid for expansion of output? In this movement Northern Rhodesia is well to the fore, but the recent stoppage, albeit of only a few days' duration, was a reminder that there are difficulties to be overcome. At the moment coal, or lack of it, is the chief bar to uninterrupted working in Rhodesia, but in regard to expansion, much of which is likely to be in the form of electrolytic, the mines are finding that they must wait for the necessary plant and machinery. It must be presumed that all possible assistance in this direction is being given by our Government, for obviously the more copper we can have from the sterling areas the less drain on our dollar resources. Transport is quite a problem in Northern Rhodesia, for distances are great and the railway system is usually taxed to the uttermost. Shipment is made from the East Coast port of Beira.

Government's Profit on Geevor Tin

Reference to a differential of £13 10s. per ton between the price at which the Government secures the company's tin and sells it, is criticised by Mr. G. W. Simms, chairman of Geevor Tin Mines, Limited, in his statement accompanying the 1947-48 accounts. He says that the differential is quite unjustified by any service rendered. "The only cost the Government need incur in disposing of the tin is approximately £1 10s. per ton. It is thus making a profit of about £12 on every ton of tin we produce," Mr. Simms continues. In the Government's buying of Malayan tin, the price differential is £1 10s. per ton only, and he urges that "the reason for this disparity in price differential should be clearly stated."

He calls for adequate taxation relief for the Cornish tin-mining industry, which would give that encouragement which is so badly needed.

MR. WILLIAM H. CATHCART, who for 26 years was a metallurgist with Lobnitz & Company, Limited, Renfrew, died on September 16. He was the author of several publications, including the "Value of Science in the Smithy and Forge." For 20 years he was lecturer at evening classes for blacksmiths in the Royal Technical College, Glasgow. Before joining Lobnitz & Company, from whom he retired in 1944, Mr. Cathcart was for 17 years foreman blacksmith with the North British Locomotive Company, Limited, Glasgow, and he was manager of the firm's Marne shell forge during the first world war.